KRAPFIELLA MIRABILIS, PRESTON, AND ITS AFFINITIES.

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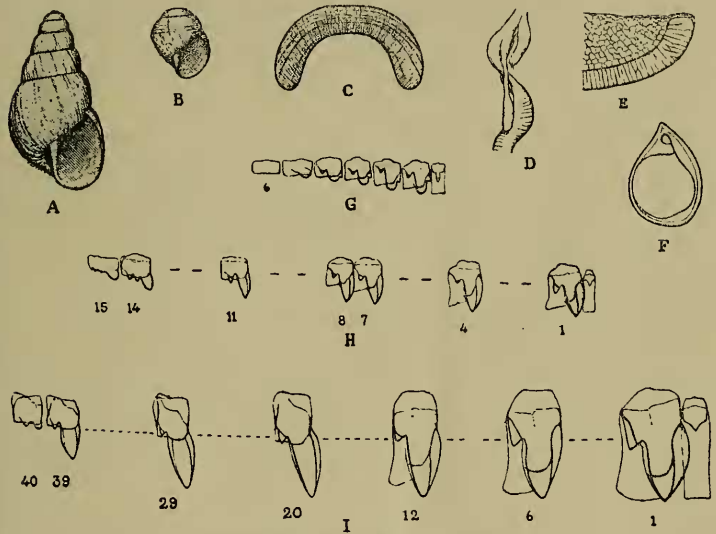
In 1911 Mr. Preston described a new shell from Mount Kenya, which seemed to him to be so singular that he named it *Krapfiella mirabilis*, establishing a new genus for its reception.[1] Through the kindness of Major M. Connolly and Mr. W. Falcon, I have lately received a specimen of this remarkable species, collected by Colin Harries in the Ndarugu River Valley, Kenya Colony, probably about 50 miles from Nairobi. The aperture of the shell was closed by a moderately thick epiphragm, and behind this I found some shrivelled remains of the animal, together with four embryos, indicating that the snail is viviparous.



Krapfiella mirabilis, Preston.

FIG.

A. Full-grown shell. × 1.
B. Embryonic shell. × 2.
C. Jaw. × 10.
D. Part of reproductive system. × 1·5.
E. Hinder end of foot. × 3.
F. Mantle-edge. × 1·5.
G. Teeth from near front end of embryonic radula. × 200.
H. Teeth from near hind end of embryonic radula. × 200.
I. Teeth from full-grown radula. × 200.

[1] Ann. Mag. Nat. Hist., ser. VIII, vol. vii, p. 472, pl. xii, figs. 25A, 25B. Two additional and much larger species of *Krapfiella* were subsequently described by Preston in these *Proceedings* (vol. x, 1913, pp. 283–4).

The embryonic shell (Fig. *B*) consists of $2\frac{1}{2}$ whorls, and measures alt. 4·7 mm., breadth 4 mm. It is ovate in form, and very narrowly perforate, the columellar lip being reflected over the perforation, and showing an oblique but almost obsolete fold. The periphery is distinctly angled, and above this angle the shell is furnished with about a dozen very strong and regular spiral striæ. These striæ are well shown in Preston's photograph of the apex of the shell (Fig. 25*B*). Near the aperture the spiral striæ are crossed by other less regular striæ parallel to the outer lip.

The parent shell (Fig. *A*) agrees closely with Preston's description, only differing from the original specimens of the species in being very slightly more slender. The umbilicus is not quite so narrow as in the embryo, and there is no trace of a columellar fold. The peripheral angle disappears completely during the course of the last whorl. The yellowish periostracum is very faintly marked with numerous spiral lines, but the spiral striæ of the protoconch are entirely absent from the post-embryonic whorls, and the oblique riblets which take their place become less pronounced on the lower whorls. Under the microscope exceedingly fine striæ can be seen parallel to the lines of growth.

The foot (Fig. *E*) is broadly rounded at the hinder end, and has an undivided sole. Deep peripodial grooves cut off a broad foot-fringe, crossed by numerous transverse grooves. There is a rather poorly developed caudal mucous gland, opening by a vertical slit. A median longitudinal groove is present on the top of the hinder portion of the foot.

The mantle-edge (Fig. *F*) bears well-developed right and left body-lobes, the left being divided into two portions connected by a low ridge. The jaw (Fig. *C*) is about ·2 mm. broad, strongly arched, of moderate thickness, and vertically striated. The radula of the full-grown specimen (Fig. *I*) measures about $5 \times 2{\cdot}2$ mm. when flattened out. The central tooth is very narrow, with a single, very small degenerate cusp. The lateral and marginal teeth are bicuspid, having large mesocones and small ectocones, the mesocones of the marginal teeth being particularly long in comparison with the size of the quadrate bases. The mesocones are furnished with lateral flanges, the inner flange being the broadest, especially on the first lateral tooth, where it overlaps the base of the central. The transverse rows of teeth are not quite straight, but trend slightly forwards on each side of the middle line. The radular formula is $(30 + 13 + 1 + 13 + 30) \times 83$.

The embryonic radula is specially interesting. The specimen examined has fifty-nine rows of teeth, and measures (when flattened out) about 1·4 mm. in length. In breadth it increases from ·25 mm. at the front end to ·6 mm. at the hinder end. Besides being smaller, the teeth near the hinder end of the radula (Fig. *H*) differ from those of the adult in being somewhat broader in

proportion to their length. The cusp of the central tooth is not quite so small; the mesocones of the other teeth are shorter, and two ectocones are present on some of the marginal teeth. The number of teeth in one of the posterior rows is 9 + 7 + 1 + 7 + 9. Further forwards the number of teeth diminishes, until near the front of the radula a transverse row only contains 3 + 3 + 1 + 3 + 3. The form of the teeth also gradually changes (Fig. *G*). They become still broader and shorter; the central tooth becomes relatively larger, with a prominent narrow median cusp and traces of a minute lateral cusp on each side of it; the mesocones of the other teeth become rounded, and their inner flanges become partly separated from them, so as to form distinct endocones. Thus, with the exception of the extreme outer marginals, which have no cusps, all the teeth at the front end of the embryonic radula are more or less tricuspid.

The other internal organs were unfortunately so shrivelled and decayed that it is not possible to describe them. All that could be made out of the reproductive organs is shown in Fig. *D*.

Affinities.—Although evidently belonging to the Achatinidæ, *Krapfiella mirabilis* differs considerably from most members of that family both in its radula and in its foot. There is, however, one genus of the Achatinidæ, namely *Pseudoglessula*, in which the radula and the foot bear a remarkably close resemblance to those of the present form. Moreover, the shell of *Krapfiella mirabilis* is not very unlike the type found in the species of *Pseudoglessula* belonging to the subgenus *Kempioconcha*, in which the columella is not truncate or folded, and a narrow umbilicus is usually present. The chief differences between *Krapfiella* and *Pseudoglessula* are to be found in the broad, rounded apex of the former genus, and especially in the apical structure; for in both *Kempioconcha* and *Pseudoglessula*, *s.s.*, the protoconch bears strong vertical ribs, very unlike the regular spiral striæ of the present species. Nevertheless, there can be little doubt that *Krapfiella* is fairly closely related to *Pseudoglessula*.

These two genera together form a very aberrant group of the Stenogyrinæ, differing from the other known forms in their deep peripodial grooves and caudal mucous pore—in which they resemble the Ferussaciinæ and the families of the Aulacopoda—and also in their peculiar type of radula. Pilsbry has pointed out, however, that the radula in *Pseudoglessula* somewhat resembles that of a rapacious snail,[1] and the marginal teeth of these genera certainly bear a suggestive similarity not only to those of *Arion*, but also to the teeth of the Oleacinid genus *Varicella*. Probably, therefore, the peculiarity of the radula in *Krapfiella* and *Pseudoglessula* may

[1] Bull. Amer. Mus. Nat. Hist., vol. xl, 1919, p. 148.

be partly due to their common Stenogyroid ancestor having developed more or less carnivorous habits. This hypothesis is supported by a study of the embryonic radula of *Krapfiella mirabilis*; for, as we have seen, the lengthening of the teeth, and especially of the mesocones, has not taken place in the early rows of the embryonic radula, and only to a limited extent in the later rows. Further, we find that the endocones that occur so frequently in the Stenogyrinæ are present towards the front end of the radula, though later they become converted into the broad inner flanges of the mesocones. Thus, in its development the radula seems to recapitulate to some extent the characters of its probable progenitors, and to suggest that *Krapfiella* and *Pseudoglessula* have sprung from a more typical Stenogyroid ancestor.